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Report to Congressional Requesters

June 1998

NATIONAL MISSILE DEFENSE

Even With Increased Funding, Technical and Schedule Risks Are High

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National Security and
International Affairs Division

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June 23, 1998

The Honorable Carl Levin
Ranking Minority Member
Committee on Armed Services
The Honorable Jeff Bingaman
Ranking Minority Member
Subcommittee on Strategic Forces
Committee on Armed Services
United States Senate

This report responds to your request that we review the National Missile Defense (NMD) program funding requirements and schedule and technical risks. Specifically, you asked us to determine (1) why the Department of Defense (DOD) significantly increased the program's near-term funding in its May 1997 Quadrennial Defense Review,[1] (2) how funding increases authorized and appropriated by Congress for the program in fiscal years 1996 through 1998 have been used or are planned to be used, and (3) DOD's planned level of future funding for the NMD program and planned uses for those funds. You also asked for an assessment of the program's current schedule and technical risks. We provided an initial assessment of the schedule and technical risks in our December 12, 1997, report[2] to you. This report updates that assessment.

You also asked us to review a report covering some of these same issues that DOD was to provide to the Committee on Armed Services by February 15, 1998. We were unable to review that report because DOD had not released it, as of May 21, 1998.

Background

The primary mission of NMD is to defend the United States against an intercontinental ballistic missile attack consisting of several missiles launched from a rogue nation. It would also have some capability against an accidental launch from nuclear powers such as Russia or China. The United States has been developing technologies for use in an NMD system for a number of years. In April 1996, DOD changed the purpose of the NMD program from a technology readiness program to a deployment readiness program and designated NMD as a major defense acquisition program.

[1]The Quadrennial Defense Review was commissioned to provide a comprehensive examination of the defense strategy, force structure, force modernization plans, infrastructure, budget plan, and other elements of the defense program and policies.

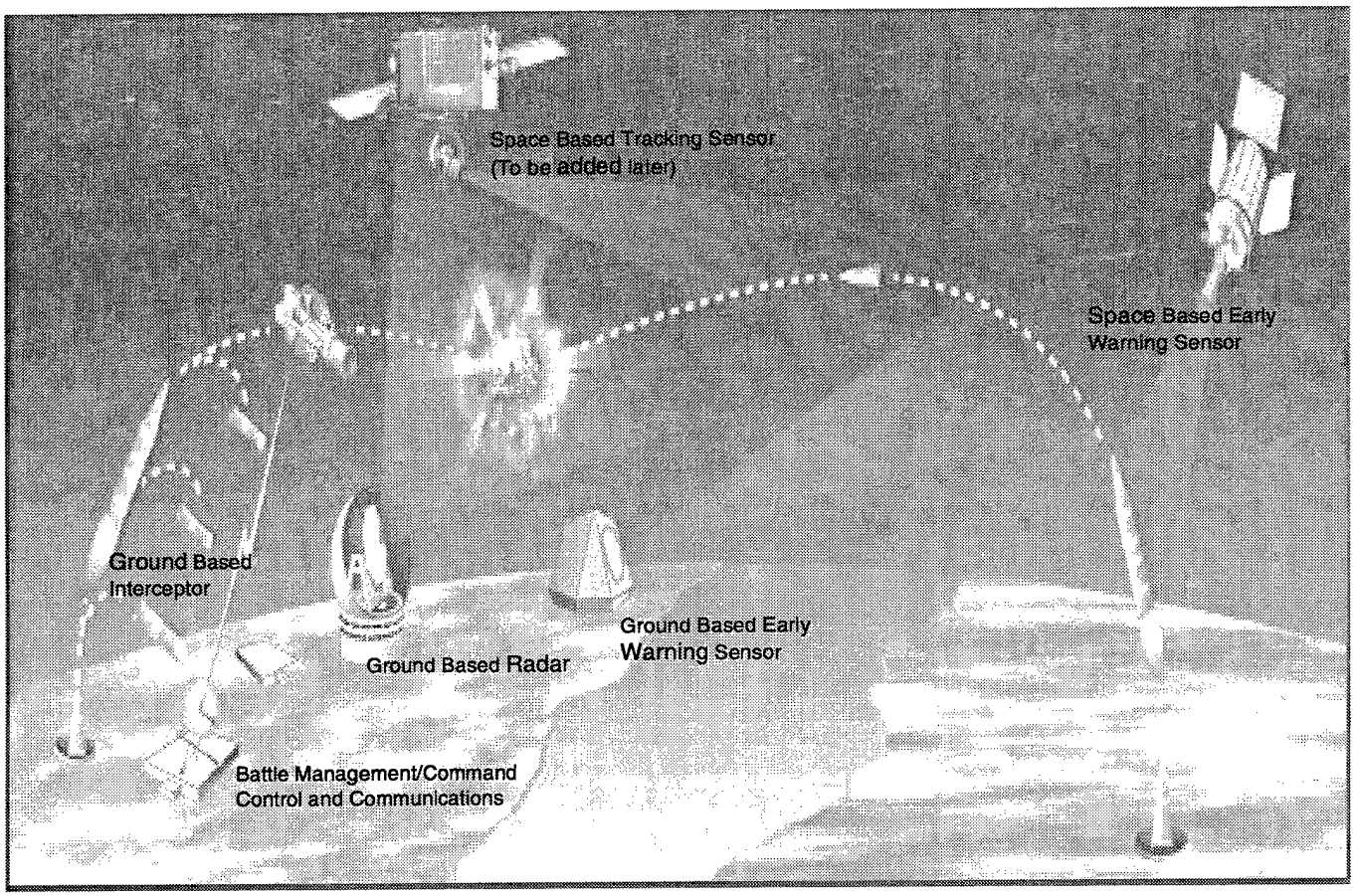
[2]National Missile Defense: Schedule and Technical Risks Represent Significant Development Challenges (GAO/NSIAD-98-28, Dec. 12, 1997).

Under the technology readiness program, the Ballistic Missile Defense Organization (BMDO) developed and matured technologies for possible use in an NMD system. Under the current deployment readiness program, BMDO plans to integrate the technologies into a system that can be made operational. The deployment readiness program is commonly known as the "3+3" program.

The goal of the NMD 3+3 program is to develop and demonstrate, by fiscal year 2000, an initial, limited capability that could be deployed by fiscal year 2003. The deployment decision is to be based on ongoing assessments of the threat and will not be made until fiscal year 2000 at the earliest. If DOD concludes at that time that the threat does not warrant deployment by fiscal year 2003, development will continue.

While BMDO is still determining the specific design of the initial NMD system, its features will include (1) space- and ground-based sensors to provide early warning of attacking missiles; (2) ground-based radars to identify and track the threatening warheads; (3) ground-based interceptors to collide with and destroy incoming warheads; and (4) a battle management, command, control, and communications system (see fig. 1).

Figure 1: Representative NMD System



Source: DOD.

The NMD system architecture will evolve over time through incorporation of advanced technologies to defend against more sophisticated threats. For example, the Space Based Infrared System—Low Earth Orbit—a group of satellites that will track incoming warheads and help discriminate between the warheads and other objects such as decoys or debris—will be added to the system at a later time. BMDO also has not determined where any NMD system would be located. NMD development is to be conducted within the terms of the Anti-Ballistic Missile Treaty,[3] but a deployed

[3]The Anti-Ballistic Missile Treaty between the United States and the former Soviet Union governs the conditions under which anti-ballistic missile systems and components can be developed and deployed. The treaty as currently formulated would limit deployment to a single site near Grand Forks, North Dakota.

system either could be compliant with the treaty as written or might require amendment of the treaty's provisions, according to DOD officials.

When the 3+3 program was established in April 1996, DOD estimated that research and development costs for the period fiscal year 1998 through fiscal year 2003 would total $2.3 billion. In May 1997, DOD released the results of its Quadrennial Defense Review, which estimated research and development costs for fiscal years 1998 through 2003 would total about $4.6 billion—almost twice as much as the April 1996 estimate.

Results in Brief

DOD significantly increased its NMD funding requirements in May 1997 because more rigorous cost estimates, based on more detailed program requirements and plans, showed that the program could not be accomplished within previously projected funding levels. The 3+3 NMD program was not sufficiently defined for detailed cost estimating when it initially changed from a technology readiness program to a deployment readiness program and was designated a major defense acquisition program in April 1996. The May 1997 Quadrennial Defense Review included the first program estimate based on detailed system descriptions, requirements, and plans.

Funding increases provided by Congress in fiscal years 1996 through 1998 were used for risk reduction activities, such as retaining competition in development of the exoatmospheric kill vehicle,[4] considered one of the most technically challenging components of the system; increasing the number of planned tests; and purchasing additional spare hardware. Congress increased funding for NMD because of concerns about the adequacy of funding to support the program. The BMDO Director acknowledged in April 1996 testimony that an additional $350 million a year could be used to reduce program risks.

Future NMD funding requirements will depend in large part on the system design and architecture and when and where it is deployed. Details on the specific system and location are not expected for some time. To identify possible future funding needs, BMDO has estimated four different scenarios. Program life-cycle costs[5] associated with these scenarios ranged from

[4]The exoatmospheric kill vehicle is the front end of the ground-based interceptor that will see the target and destroy it by colliding with it, outside the atmosphere.

[5]Life-cycle costs include costs to develop and produce system components, construct facilities, deploy the system, and operate it for 20 years.

$18.4 billion for a deployment at Grand Forks, North Dakota, by fiscal year 2003 to $28.3 billion for a deployment by fiscal year 2006.

Since our December 1997 report, DOD has increased funding and revised NMD program plans to mitigate schedule and technical risks. However, program officials told us that even with the mitigation actions resulting from the increased funding, schedule and technical risks associated with a 2003 deployment remain high. According to a February 1998 report of a panel of former senior military, government, and industry officials, successful execution of the 3+3 program on the planned schedule is highly unlikely. This panel concluded that the program would benefit from the earliest possible restructuring to contain the risk.

NMD Program Not Sufficiently Defined for Reliable Cost Estimate at the Time 3+3 Program Was Established

The NMD cost estimate has evolved as the system requirements and program plans have become better defined. When the NMD program was changed to a deployment readiness program in April 1996, plans and requirements were not sufficiently defined to allow the development of a reliable cost estimate. Fiscal year 1996 and 1997 budget requests were submitted to Congress before the program was changed to a deployment readiness program.[6]

In late 1995 and early 1996, DOD conducted a "Program Update Review" to determine how to proceed with the NMD program. The review considered a number of options for NMD. The option selected included an integrated test in fiscal year 1999 and a possible deployment decision in fiscal year 2000. DOD estimated that research, development, and test and evaluation costs for this option would total about $2.3 billion for fiscal years 1998 through 2003. According to program office officials, the update review was based on a "rough order of magnitude" cost estimate derived from engineering judgment and field estimates. Detailed system requirements had not been established from which to make a formal, documented cost estimate.

Once NMD became a deployment readiness program in 1996, the focus changed from technology and component development to development and testing of a system that could be quickly deployed. One of the first steps was to define operational requirements for the system. U.S. Space Command defined broad requirements for an NMD system in August 1996. This was followed by NMD's first system requirements review held in November 1996. Once these requirements were known, they had to be

[6]The fiscal year 1996 budget was submitted in February 1995 and the fiscal year 1997 budget request was submitted in March 1996.

defined in sufficient detail so that the contribution of each system component to the requirement could be determined. According to DOD officials, it was only after these detailed requirements were established that detailed cost estimates could be produced.

The NMD program office used the requirements data to prepare a new, more rigorous cost estimate. DOD's Office of Program Analysis and Evaluation also prepared an independent cost assessment. These estimates were not completed in time to affect the fiscal year 1998 President's budget request. The program office estimated that about $4.6 billion would be required for research, development, test, and evaluation—about $2.3 billion higher than previous projections. The independent assessment confirmed the program office's projection of research, development, test, and evaluation costs. As a result of these estimates, it was apparent to DOD officials that the NMD program was significantly underfunded. According to DOD officials, these were the first disciplined, system-level cost estimates based on requirements necessary to field an NMD system.

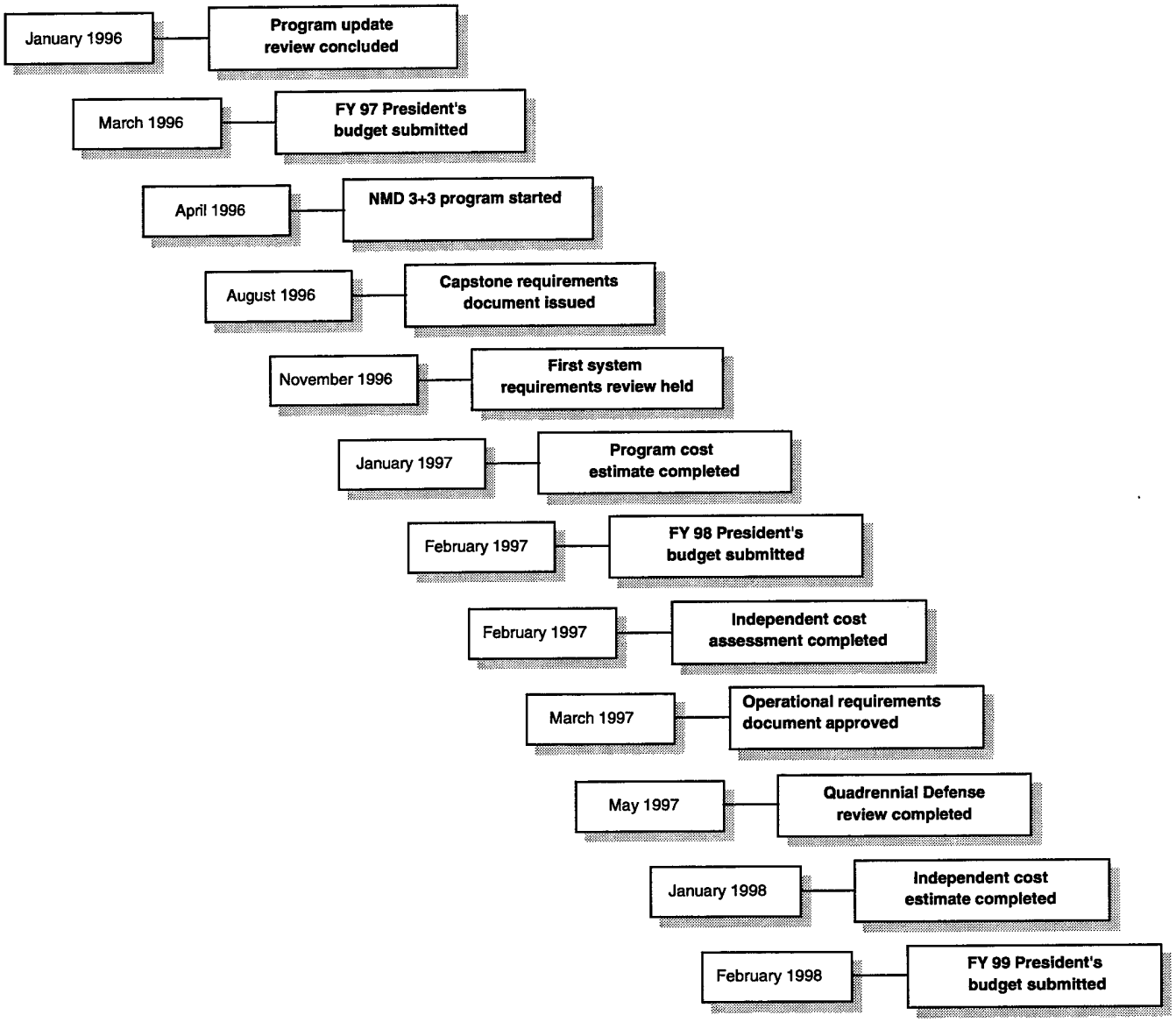
The Quadrennial Defense Review, which was underway at the time the estimates were prepared, examined three options for the NMD program:

- The first option was to keep NMD within its current budget, which would mean that system deployment would be delayed by at least 3 years or that the program would once again become a technology readiness program.
- The second option was to increase program funding to the levels indicated by the new estimates—an increase of about $2 billion in fiscal years 1998 through 2003—in order to maintain the 3+3 program schedule. Even with the additional funding, however, schedule risks were predicted to remain high.
- The third option was to increase program funding by up to $1.5 billion but also extending the schedule by about 3 years.

The review recommended the second option—increased funding to maintain the option to make a deployment decision in 2000. The Secretary of Defense asked Congress to increase the fiscal year 1998 budget request for NMD by $474 million. Congress appropriated the requested additional funds. DOD estimated that an additional $1.8 billion would be needed for fiscal years 1999 through 2003, bringing the total increase to about $2.3 billion. The amount of increased funding was based on the Office of Program Analysis and Evaluation's independent cost assessment.

Figure 2 shows the chronology of events leading to the cost estimate used in the Quadrennial Defense Review.

Figure 2: Chronology Leading Up to Cost Estimate Used in Quadrennial Defense Review



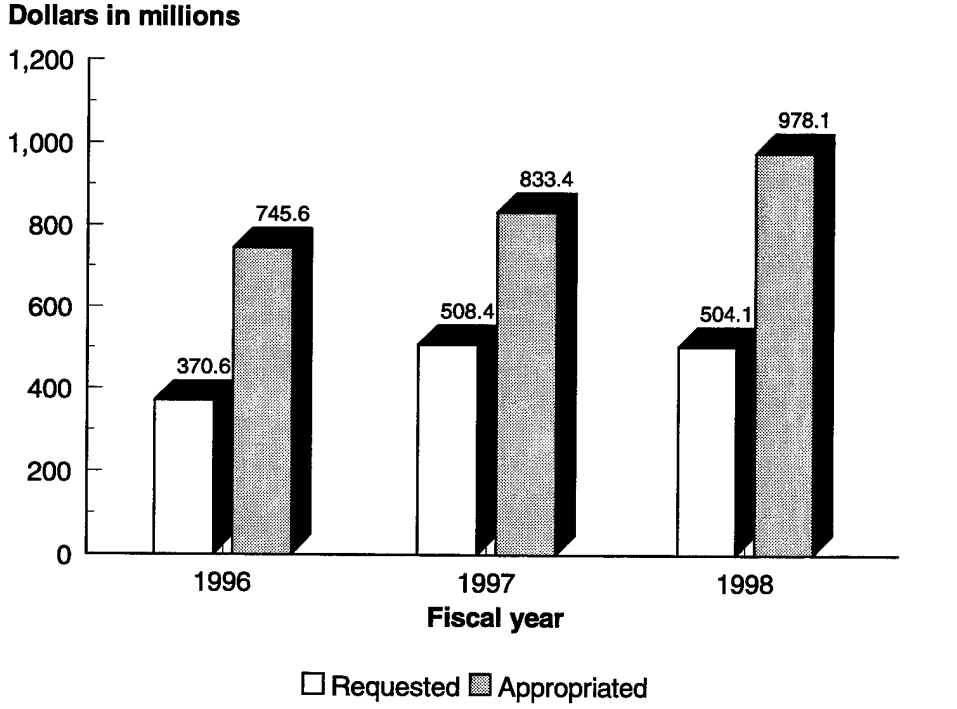
Congressional Funding Increases Used for Risk Reduction Activities

Congress authorized and appropriated significantly more funds in fiscal years 1996 through 1998 than were requested in the President's budgets for those years because of its concerns that the budget requests were not adequate. DOD officials acknowledged in testimony that additional funds were needed to reduce program risks. Funding increases have been used primarily for risk reduction activities, such as extending the exoatmospheric kill vehicle design competition until after competing designs are more fully tested.

Congressional Funding Increases

Because of concerns about the adequacy of funding to support the deployment readiness program and based on testimony by senior defense officials, Congress appropriated significantly more funds for the NMD program in fiscal years 1996 through 1998 than were requested in the President's budgets for those years. Figure 3 shows the President's initial budget requests for research, development, test, and evaluation funds for fiscal years 1996 through 1998 and the amounts actually appropriated.

Figure 3: Funding Requested and Appropriated for NMD Program in Fiscal Years 1996 Through 1998 (research, development, test, and evaluation funds only)



Even though no detailed estimate of NMD costs had yet been performed, senior DOD officials testified that funding in excess of the President's budget requests would be needed to plan a program with acceptable risks. For example, in April 1996, the BMDO Director said that an additional $350 million above the President's budget requests in fiscal years 1997 through 1999 could be used to achieve a lower risk 3+3 program. He proposed using the additional funding to increase testing, accelerate development of a booster for the ground-based interceptor, buy spare hardware to eliminate single point failures, continue competition between the two kill vehicle contractors until after at least one additional flight test per contractor, and increase deployment planning and preparations.

DOD Use of Congressional Funding Increases

In fiscal years 1996 through 1998, Congress authorized and appropriated a total of $1,174 million more than the President's budget requests for those years. Over 80 percent of additional funding has been allocated to six program areas—the ground-based interceptor; ground-based radar; systems integration; battle management, command, control, and communications system; systems engineering; and test and evaluation. According to NMD officials, these funding increases have been or are being used for risk reduction activities and to execute the 3+3 program. Table 1 shows how the funding increases for the 3-year period, fiscal years 1996 to 1998, have been allocated. Appendix I shows, in detail, the amounts budgeted and actual or planned program allocations for projects in fiscal years 1996 through 1998.

Table 1: Allocations of Congressional Funding Increases for Fiscal Years 1996 Through 1998

Dollars in millions

Program area	Funding increase	Percent of total
Ground-based interceptor	$434	37
Systems integration	159	14
System test and evaluation	149	13
Ground-based radar	107	9
Battle management, command, control, and communications	72	6
Systems engineering	57	5
Other	196	17
Total	**$1,174**	**100**

Note: Totals may not add due to rounding.

The largest increase—$434 million or over one-third of the 3-year total—has been allocated to the ground-based interceptor. Most of these funds have been used to maintain competition in the design and development of the interceptor's kill vehicle. Original plans were to select a single kill vehicle design and contractor at the end of 1995 before either of the two competing designs had been fully tested—even though the kill vehicle is considered one of the most complex parts of the NMD system. The additional funding has allowed the program to preserve the kill vehicle competition through actual intercept tests in fiscal year 1999. Some of the increased funding was also needed to cover the costs of a schedule slippage due to the failure of a flight test in January 1997, purchase a spare kill vehicle from one of the contractors, and upgrade launch capabilities at the test range. Because of subsequent funding reductions[7] and a decision to incorporate the ground-based interceptor into a lead system integration contract, program officials decided not to begin development of a booster for the interceptor.

Increases totaling $159 million allocated to systems integration have been used to obtain a prime contractor for the system. According to program officials, BMDO decided in the summer of 1996 that a prime contractor would be needed to manage the remaining design and development effort and to integrate and test the complete NMD system. Two competitive concept development phase contracts were awarded in fiscal year 1997. One of two concept development phase contractors, Boeing North American Company, was selected as the prime contractor on April 30, 1998.

An increase of $149 million in the system test and evaluation effort has been used in part for additional test targets. Some of the increased funding has also been used to develop an integrated system test capability needed for ground tests of the various elements of the NMD system. The added funding also permitted increased testing such as using targets of opportunity to test ground-based system elements and a Midcourse Space Experiment designed to obtain information on viewing targets against earth and space backgrounds—a critical capability in identifying and tracking threatening warheads.

Funding increases amounting to $107 million allocated to the ground-based radar have been used to enhance realism in and to accelerate development of the radar that will be used in testing. Original

[7]Because of changes in inflation assumptions and other cuts mandated by DOD and Congress in fiscal years 1996 through 1998, NMD funding was reduced by a total of about $80 million below the amounts appropriated for the program in those years.

plans were to conduct the tests with a radar technology demonstrator. However, with the increased funding, BMDO decided to construct a ground-based radar prototype to be used in the testing program. The prototype has a larger face than the demonstrator and more closely resembles the radar to be deployed. Additionally, the radar development was accelerated.

After NMD became a deployment readiness program, officials said that it became apparent that a more extensive battle management, command, control, and communications effort was needed to support an NMD system. This effort is supposed to provide engagement planning and execution, allow human-in-control of the NMD system, and interface with external command, control, and communications systems. With $72 million in additional funding allocated to this element, officials have been able to begin development of five capability increments of a prototype battle management, command, control, and communications system. The first two increments have been completed and the third was expected to be completed in April 1998. Also added was the NMD communication network and a system that will be used to communicate with the NMD interceptor in-flight.

Originally planned funding levels for systems engineering were sufficient only to support a technology readiness program, according to program officials. Funding for this effort was increased by $57 million, mostly in order to prepare and update documents required for a system deployment. The officials said that without the additional funding, they would not have been able to baseline the NMD system architecture, and, thus, there would not be an NMD system.

The remaining $196 million of the increases was allocated in smaller increments to a number of areas. The largest of these was an increase of about $50 million for program management support. The increase paid for personnel and contractor support for the joint program office as well as for systems analyses and small business innovative research. Personnel costs previously spread through all the projects were rolled up into one project management line item.

Future Funding Requirements Depend on Variables Yet to Be Chosen

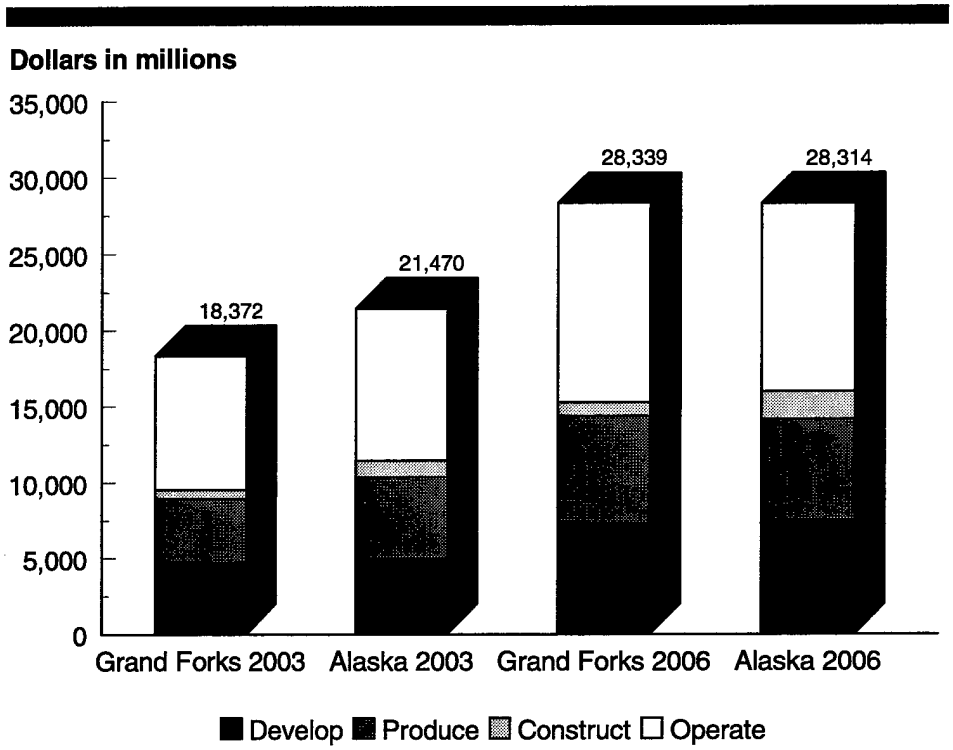
Future NMD funding requirements depend in large part on how the system is designed and when and where it will be deployed. These factors may not be known for some time. For example, the government and prime contractor have not yet agreed on a final system design. The deployment schedule and location will not be known until at least the fiscal year 2000 deployment review. To provide a basis for estimating near-term funding requirements and to help determine how these differences will impact future funding needs, the program office prepared four different life-cycle cost estimates, based on two locations—one at Grand Forks, North Dakota, and the other in Alaska—and two capability levels—one available in fiscal year 2003 and the other in fiscal year 2006.[8] The life-cycle cost estimates show the total costs to develop and produce system components, construct facilities, deploy the system, and operate it for 20 years.

Figure 4 shows the life-cycle costs estimated for each deployment alternative.[9]

[8]An initial operating capability would be established in fiscal year 2006, but the full operating capability would not be achieved until fiscal year 2009.

[9]Estimates include an allowance for inflation and are intended to reflect the purchasing power in the year that funds are expended.

Figure 4: NMD Program Life-Cycle Cost Estimates



None of the estimates include costs incurred prior to fiscal year 1998.[10] Because specific designs have not yet been determined for system components, the estimates are based on assumptions about which designs will be chosen. The cost estimates could change based on decisions made by the prime contractor, or evolution of the threat.

The higher cost for a deployment in Alaska by 2003 is due, in large part, to the fact that less infrastructure currently exists there, transportation costs are higher, the construction season is shorter, and the environment is harsher. Procurement and operation and support costs are primarily dependent on the type and amount of hardware included in the deployment. Research and development costs would be slightly higher for an Alaska deployment primarily because of the need for additional site survey studies.

The 3+3 program is designed to enable a system to be deployed as early as fiscal year 2003, but a more capable system could be operational in fiscal

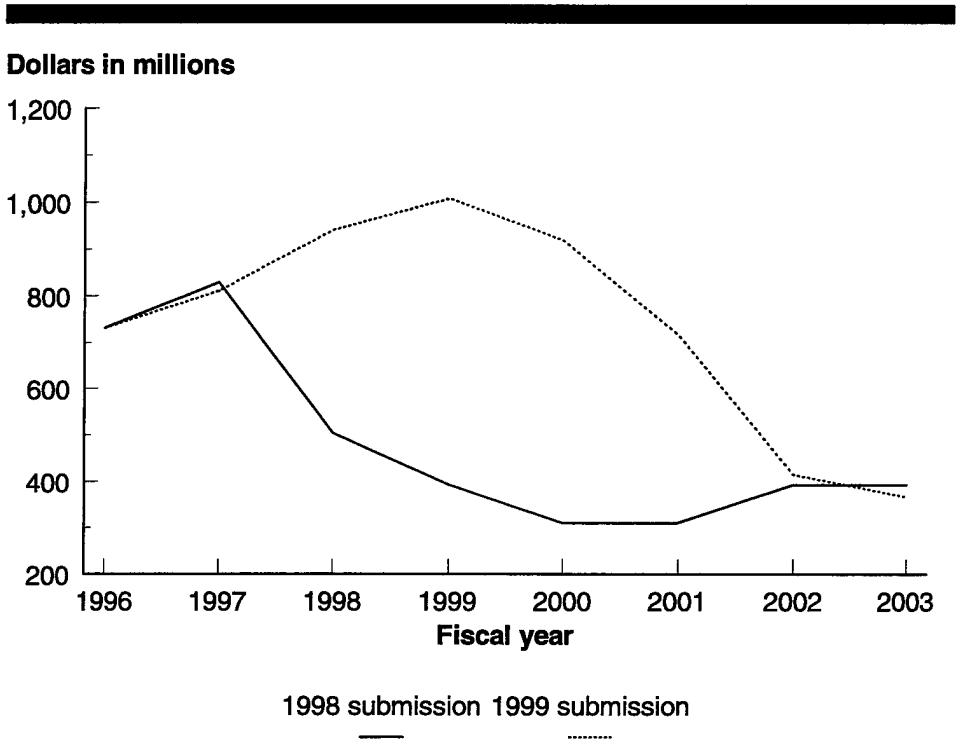
[10]Congress appropriated about $1.6 billion in fiscal years 1996 and 1997 for the NMD program.

year 2006, according to BMDO. The primary differences between the two capability levels used in the cost estimates are in the type and amount of hardware included. For example, the more capable system would have significantly more interceptors, fewer ground-based radars, but would also include a space-based sensor system. After the space-based sensor system is deployed, fewer ground-based radars will be needed for an Alaskan deployment because of Alaska's location relative to potential threats. The requirement for fewer radars is the primary reason an Alaskan deployment by fiscal year 2006 is estimated to have a life-cycle cost slightly less than a deployment at Grand Forks in that same time frame. With fewer radars, operating costs would also be lower in Alaska.

The Office of Program Analysis and Evaluation also prepared independent estimates of NMD program costs in January 1998. According to officials responsible for the estimate, costs in the independent estimates were about 10 percent higher than the estimates prepared by the program office, due primarily to the fact that the independent estimates included "pre-planned product improvements" not included in the program office estimates. DOD did not provide us access to the January 1998 independent estimates. Therefore, we could not confirm what officials told us about them.

DOD included funding in its future years defense plan to complete the research and development phase of the initial capability NMD program based on the cost estimate used in the Quadrennial Defense Review. No funding has been identified for production and deployment of the system. According to BMDO, funds for system production and deployment will not be included until after the fiscal year 2000 deployment decision review. Figure 5 compares the President's budget submissions for fiscal years 1998 and 1999.

Figure 5: NMD Funding Estimates Associated With President's Budgets for Fiscal Years 1998 and 1999



Note: Amount shown for fiscal year 1996 is the amount actually appropriated.

Even the fiscal year 1999 funding estimate does not include amounts that will be needed beginning in fiscal year 2001 to develop system improvements to keep up with changes in the threat. According to one estimate, about $765 million above the President's fiscal year 1999 budget estimate will be needed in fiscal years 2001 through 2003 to develop the upgrades.

Schedule and Technical Risk Remain High

In December 1997, we reported that DOD faces significant challenges in the NMD program because of high schedule and technical risk. We pointed out that schedule risk was high because the schedule requires a large number of activities to be completed in a relatively short amount of time. Some development activities are not able to proceed in earnest until the government and prime contractor agree on a final system design. Furthermore, developing and deploying an NMD system in the 6 years allotted under the 3+3 program will be a significant challenge for DOD

given its past history with other weapon systems. For example, NMD's acquisition schedule is about one-half as long as that of the Safeguard system, the only U.S.-based ballistic missile defense system developed so far. The program's technical risk is high because the compressed development schedule only allows limited testing. The NMD acquisition strategy called for conducting (1) one system test prior to the initial deployment decision—a test that would not include all system elements or involve stressing conditions such as multiple targets—and (2) one test of the integrated ground-based interceptor before production of the interceptor's booster element must begin. If subsequent tests reveal problems, costly redesign or modification of already produced hardware may be required.

Since our December report, DOD has revised program plans to mitigate schedule and technical risk to some extent. Changes include procuring additional spare hardware to protect against further schedule slips and increasing the amount of planned testing. DOD officials told us, however, that overall schedule and technical risk associated with a 2003 deployment will remain high, despite these actions.

Schedule Risk

Even with the additional funding, the program's schedule risk will remain high, according to DOD officials. Accomplishing all of the required contracting, development, integration, and testing planned before the initial decision point in fiscal year 2000 is, and will continue to be, high risk. According to the program manager, additional funding cannot be used to reduce schedule risk because "we simply cannot buy back time." However, the additional funds can help mitigate further slips in the program schedule, according to the program manager. For example, additional funds have been identified to purchase back-up hardware to prevent unnecessarily long delays in test programs if something goes wrong, as it did in January 1997 when a test had to be aborted after the target was launched. That test could not be repeated for about 6 months due to the lack of a back-up target.

In February 1998, a panel of former senior military, civilian, and industry leaders confirmed our assessment that the 3+3 program contained high schedule risk.[11] According to the study panel, which was established by BMDO, the Director of Operational Test and Evaluation, and the Director of Test, Systems Engineering and Evaluation, schedule pressures on NMD

[11]Institute for Defense Analyses, Report of the Panel on Reducing Risk in Ballistic Missile Defense Flight Test Programs, February 27, 1998.

have created a planning environment at least as optimistic as that which led to test failures and delays in other missile defense programs. In the judgment of the study panel, successful execution of the 3+3 program on the planned schedule is highly unlikely. The panel recommended restructuring the program to contain the risk and eliminate unrealistic expectations.

Technical Risk

Technical risks remain high for a fiscal year 2003 deployment even though the program has made some technical progress and has revised plans to increase the amount of testing prior to deployment. The amount of flight testing is still limited compared to other programs. Other outside reviewers have also commented on the limited amount of flight testing planned for the program.

Since our December 1997 report, the program has made some technical progress. In January 1998, BMDO conducted its second kill vehicle sensor test. An earlier test in June 1997 included a sensor built by a competing company. The purpose of both tests was to analyze the ability of the respective sensors to identify and track objects in space. According to DOD, both sensor tests were successful. The sensors successfully tracked and obtained data needed to identify simulated threat targets and decoys. The two competing contractors are scheduled to test the ability of their kill vehicle designs to actually intercept targets in space during fiscal year 1999. This data will be used to select a single kill vehicle design and contractor.

As a result of added funding, BMDO has also increased the number of tests planned. For example, BMDO almost doubled the number of planned integrated ground tests,[12] added one integrated flight test prior to the fiscal year 2000 deployment readiness review, and increased the number of flight tests planned between the readiness review and the system's initial operational capability date. The number of flight tests to be conducted after the readiness review depends on whether or not a decision is made to deploy. Without a deployment decision, there will be two integrated flight tests per year. If a deployment decision is made in fiscal year 2000, with a target deployment of fiscal year 2003, there would be three flight tests in fiscal year 2000, and four a year in fiscal years 2001 through 2003.

[12]Integrated ground tests will be conducted with certain hardware and software components integrated into simulations. Although they are used to evaluate system performance, they do not include actual targets or interceptor firings.

Overall technical risk associated with a fiscal year 2003 deployment remains high because the amount of testing, although increased, is still limited compared to other programs. Even after the increase in the number of tests, the program manager told us that in his view, the planned flight test program is anemic. The program plans a maximum of 16 system level flight tests through the end of fiscal year 2003, the earliest planned deployment date. By contrast, the Safeguard[13] program included 111 flight tests before the system became operational. Of these 111 tests, 70 were intercept tests, 58 of which were successful. The panel on reducing risk in ballistic missile defense programs also concluded that plans for the 3+3 program are based on inadequate test assets and testing. The panel recommended increasing the number of tests (both ground and flight tests) and that the flight test program be restructured to allow more time between tests to ensure that problems are corrected and the corrections are tested.

Technical risk in the NMD program is also of concern to DOD's testing organization. According to the Director of Operational Test and Evaluation's Annual Report for fiscal year 1997, the planned NMD test program will provide only a limited basis for evaluating system performance. The limitations cited in the report include (1) the limited amount of testing planned prior to the deployment readiness review; (2) the fact that the booster to be used in the ground-based interceptor will not be tested prior to the readiness review; (3) the interface between the system's battle management, command, communications, and control element and the national command authority will not be tested before the decision review; (4) the system's performance against multiple targets will not be tested; and (5) models and simulations used to support the review will have minimal validation by real flight data.

NMD program officials told us that they are in the process of redefining the program's risk. The new risk assessment is scheduled to be completed and documented in June 1998. They also pointed out that the prime contractor's system design and program plans may impact risk. According to the program's test and evaluation master plan, the amount of testing is unlikely to change as a result of prime contractor selection.

[13]Safeguard, the only other U.S.-based missile defense system, became operational in 1975. The program was terminated in 1976.

Conclusions

The May 1997 Quadrennial Defense Review recommended significant increases in NMD funding. The increases resulted in large part from a better definition of system requirements and program plans. As requirements and plans evolved, estimated development costs almost doubled. Increased funds provided by Congress in fiscal years 1996 through 1998 have enabled BMDO to conduct risk reduction activities, such as purchasing back-up hardware and preserving competition for the development of the exoatmospheric kill vehicle. However, despite the additional activities, the risk of the program being completed on its current schedule is still high. Also, any decision in fiscal year 2000 to deploy an NMD system by 2003 would involve high technical risk because the associated compressed schedule will permit only limited testing of the system.

Agency Comments

In commenting on a draft of this report, DOD concurred that the NMD program "faces significant challenges because of high schedule and technical risks." DOD also provided technical comments, which we incorporated as appropriate. DOD's comments are reprinted in appendix II.

Scope and Methodology

To identify changes that led the May 1997 Quadrennial Defense Review to recommend significant increases in near-term funding for the NMD program, we compared documentation available to support the review estimate to documentation available to support earlier estimates such as the 1996 Program Update Review. We discussed differences and reasons for them with NMD, BMDO, and DOD officials responsible for estimating NMD program costs.

To determine how funding increases authorized and appropriated by Congress for fiscal years 1996 through 1998 were or are planned to be used, we compared original budget documents to current funding allocation documents and discussed reasons for differences with officials responsible for managing various elements of the NMD program, such as the ground-based interceptor and test and evaluation managers.

To determine the level of future funding and how those funds are to be spent, we reviewed NMD's cost estimates and assessments of those estimates. We discussed the estimates and assessments with NMD and BMDO officials responsible for preparing them and with DOD officials responsible for preparing an independent cost estimate. We did not review the independent cost estimate because DOD officials did not provide us with access to it.

To assess the program's schedule and technical risk, we analyzed the program's status, strategy for accomplishing the remaining development work and meeting fielding requirements, and approaches to demonstrating the system's capabilities and military suitability. We also reviewed independent studies of the system's risk and discussed risk levels and approaches to mitigating risk with NMD program officials and the program's systems engineering contractor. We prepared an initial risk assessment in December 1997 and updated that assessment for this report.

We conducted our work from October 1997 through April 1998 in accordance with generally accepted government auditing standards.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 15 days from its issue date. At that time, we will send copies of this report to other interested congressional committees, the Secretary of Defense, and the Directors of the Ballistic Missile Defense Organization and the Office of Management and Budget. Copies will also be made available to others on request.

If you or your staff have questions concerning this report, please contact me at (202) 512-4841. The major contributors to this report were Lee Edwards, David Hand, Bobby Hall, and Judy Lasley.

Allen Li
Associate Director
Defense Acquisitions Issues

Research, Development, Test, and Evaluation Funds Budgeted and Allocated for NMD in Fiscal Years 1996 Through 1998

Dollars in millions

	Fiscal year 1996			Fiscal year 1997			Fiscal year 1998			Total
Program element	**Budget**	**Allocation**	**Change**	**Budget**	**Allocation**	**Change**	**Budget**	**Allocation**	**Change**	**increase**
Systems integration	0	0	0	0	$24.10	$24.10	$7.09	$141.73	$134.64	$158.74
Ground-based interceptor	$115.22	$255.30	$140.08	$147.85	272.00	124.15	127.55	297.46	169.91	434.14
Battle management, command, control, and communications	33.54	70.02	36.48	32.76	50.65	17.89	43.73	61.67	17.94	72.31
Ground-based radar	37.78	83.50	45.72	41.50	66.13	24.63	19.54	55.73	36.19	106.54
Upgraded early warning radars	0	8.49	8.49	9.35	12.12	2.77	16.75	15.41	–1.34	9.92
Systems engineering	20.80	60.16	39.36	30.83	47.12	16.29	41.94	42.97	1.03	56.68
Deployment planning	8.25	9.60	1.35	11.91	12.23	0.32	16.61	17.88	1.27	2.94
Program management/ support	7.56	29.65	22.09	26.89	28.43	1.54	33.47	60.05	26.58	50.21
System test and evaluation	29.33	69.73	40.40	50.76	102.87	52.11	83.71	140.51	56.81	149.31
Sensor technology	64.89	87.64	22.74	53.93	53.57	–0.36	30.28	18.38	–11.90	10.48
Other initiatives	0	0	0	0	17.40	17.40	0	0	0	17.40
Special interest	0	0	0	0	18.00	18.00	0	0	0	18.00
Mission common	53.24	56.64	3.39	69.18	74.99	5.81	51.22	54.52	3.30	12.50
BMDO Management	0	0	0	33.48	31.81	–1.68	32.22	28.58	–3.64	–5.32
Rescissions and reductions	0	14.90	14.90	0	22.02	22.02	0	43.21	43.21	80.14
Total	**$370.62**	**$745.62**	**$375.00**	**$508.44**	**$833.44**	**$325.00**	**$504.09**	**$978.09**	**$474.00**	**$1,174.00**

Note: Totals may not add due to rounding.

Comments From the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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WASHINGTON, DC 20301-3000

ACQUISITION AND
TECHNOLOGY

21 MAY 1998

Mr. Allen Li
Associate Director, Defense Acquisitions Issues
National Security and International Affairs Division
U. S. General Accounting Office
Washington D. C. 20548

Dear Mr. Li:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "NATIONAL MISSILE DEFENSE: Even With Increased Funding Schedule and Technical Risks Are High," dated April 23, 1998, (GAO Code 707300), OSD Case 1594.

The Department concurs that the National Missile Defense (NMD) program faces significant challenges because of high schedule and technical risks. The report is generally accurate: Comments for technical correctness are provided.

The Department appreciates the opportunity to comment on the draft report.

Sincerely,

George R. Schneiter
Director
Strategic and Tactical Systems

Enclosure